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Nursing Shortage in the Hospital Sector, 1982-87

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NURSING SHORTAGE IN THE HOSPITAL SECTOR, 1982-87

A Background Paper Prepared by the Staff of the Secretary's Commission on Nursing and the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, USDHHS.

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ABSTRACT

This report summarizes the extent of registered nurse (RN) shortages in the short-term general hospital sector for the period 1982-1987. The findings are based on data collected by the Hospital Studies Program of the National Center for Health Services Research and Health Care Technology Assessment and use three measures of nursing shortage: (1) budgeted RN vacancy rate; (2) ratio of RNs per 100 patient days; and (3) the level of shortage as perceived by hospital and nursing administrators. These measures are used to examine several hospital characteristics for their association with the RN shortage: location and hospital structure; nursing salaries and staff mix; and casemix and financial aspects such as hospital profitability and costs per admission. While nearly all short term hospitals perceive some degree of RN shortage, apparently well-staffed hospitals, many with teaching affiliations, are more likely to perceive a severe shortage. Perceived shortages are not closely related to RN employment or budgeted RN vacancies.

The limitations of the data base on which these findings are based restrict the inferences that can be drawn. However, RN shortages appear to be related to demand for rather than the overall supply of registered nurses. All hospitals, on average, have increased their employment of RNs per patient day and their reliance on RNs relative to LPNs since 1982. High shortage hospitals in particular have used RNs to replace LPNs. Hospitals have not increased the proportion of budgets allocated to nursing services despite an increase in the ratio of RNs per patient day. Diagnostic case mix severity has increased for all types of hospitals but this increase does not appear to be related to shortages.

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I. PROBLEM STATEMENT

This report focuses on the extent and nature of the current nursing shortage in the hospital sector. Data from the 1987 AHA Hospital Nursing Personnel Survey (AHA, April 1987) indicate that over half of the hospitals participating in the survey reported an overall shortage of staff registered nurses (RNs). Approximately one fifth of hospitals reporting described the shortage as severe, 35.5 percent described the shortage as moderate, and only 23.8 percent reported no shortage. Data from this survey contrast sharply with data from similar, earlier surveys. In a 1983 survey for instance, 66.6 percent of participating hospitals reported no shortage (AHA, 1983). Current shortages are occurring at a time when there would appear to be an adequate supply of nurses. Data from the Federal Government (U.S. DHHS, 1986, 1988) show the output of nurses as doubling over the past 30 years, with over 2.1 million licensed registered nurses. Further, between 1977 and 1984 alone the number of employed nurses increased by 55 percent as compared with an 8 percent growth in the U.S. population (Aiken and Mullinix, 1987).

The nature of the currently reported shortage is even more puzzling in view of recent trends in the use of hospital services. Hospitals continue to report shortages of nurses despite declining hospital utilization and increasing employment of nurses. Since 1980 the number of available hospital beds, admissions, and average lengths of stay have all steadily declined (Latta et al., 1986; Sloan and Valvona, 1986; Farley, 1988). Yet the number of full-time equivalent registered nurses employed in hospitals increased nearly 18 percent from 1980 to 1986 (AHA, 1981 and 1987).

The introduction of the Medicare Prospective Payment System (PPS) in 1983 has drastically altered incentives affecting the decisions to hospitalize and treat a large number of patients. Twelve Medicaid and ten Blue Cross programs have announced plans to implement similar payment mechanisms, which tie reimbursement levels to specific diagnostic categories (ProPac, 1987). Other payers are restructuring incentives to discourage inpatient treatment for individuals who can be treated successfully in other settings and to encourage shorter stays for patients who are admitted to hospitals. One obvious effect of these changes has been a substantial increase in patient acuity. Several observers (e.g., Aiken and Mullinix, 1987; Wilensky, 1988) have suggested that this increasing acuity may account, at least in part, for the nursing shortage. Yet average lengths of stay declined nearly 14 percent from 1980 to 1985 in spite of these changes in hospital case mix (Farley, 1988).

Moreover, shifts in the use of hospital services are occurring at a time when the nursing profession is undergoing considerable change. With steady increases in the number of women participating in the labor force and entering other professions that have long-term career potential, such as business, law, medicine, dentistry, and the information sciences, nursing as a career choice is facing stiff competition. In response, the past decades have been marked by changes in the nursing profession, including graduate and postgraduate education and a redefinition of nursing functions and responsibilities, both with regard to patient care and the relationship of nurses to physicians and hospital management.

If there is indeed a nursing shortage, then the reasons for it are complex and require careful study.

In general terms, the supply of and demand for registered nurses should be examined in terms of four interrelated but distinct issues:

- The extent and breadth of the shortage
- Nursing salaries
- The use of other nursing staff
- Effects of changes in reimbursement mechanisms and patient acuity on patterns of hospital utilization

1. Labor market and regional factors

Changes in patterns of hiring hospital nurses and utilizing their skills need to be viewed against recent changes in women's participation in the labor force as a whole and against important regional differences regarding the availability of other work opportunities. Several researchers have suggested that the requirement for evening and night shifts and holiday work may make nursing a less attractive career option than other professions that pay at equivalent rates, provide less exacting work schedules at lower stress levels, and offer greater potential for career growth and development (Aiken and Mullinix, 1987). Data from a University of California, Los Angeles, national survey of first time college freshmen indicate a sharp decline in the proportion of women students planning to pursue nursing careers, in contrast to a threefold increase in the proportion interested in business careers (Astin et al., 1986). In addition to these global considerations of the market for nurses, special factors may affect regional markets. For example, the 1987 AHA HNPS data indicate that the reported nursing shortage is not uniformly distributed regionally or by type, size, or hospital location, and analyses of hospital market characteristics indicate a range of additional factors influencing supply and demand.

2. Nursing salaries

Nursing industry leaders note that nursing wages are not increasing at the same rate as in other professions, particularly teaching, that have traditionally attracted women. Data from the National Survey of Hospital and Medical School Salaries (University of Texas, 1987) indicate that hospital nurses have received only modest wage increases in recent years. Further, even though starting salaries of nurses are now comparable to those of other college graduates, the average maximum salary is only $7,000 higher than the average starting salary. Clearly, the relationship between nurse salary levels, reported vacancy rates, and difficulties in recruiting need hardly be stressed.

3. Staff mix

The nursing literature also shows wide variations in how hospital nurses are used in different hospital settings. In particular, RNs may be widely used to carry out a wide range of duties outside of patient care. This may be attributable to the fact that nurses are considered less expensive than other health care workers or more efficient in carrying out certain tasks (Aiken and Mullinix, 1987; McCormick, 1986). If indeed a large proportion of RNs is being used for duties other than patient care, particularly on evening and weekend shifts, this might well account for the reported shortage. Recent reports based on a limited number of hospitals, indicate a greater contraction in the LPN work force than for RNs, offset by increased demand for RNs overall (AHA,

April 1987). Certainly the staffing mix selected by a hospital, including the relation of full-time to part-time staff, RNs to LPNs, and contract to salaried staff by nursing specialty, will influence reported shortage rates.

4. Casemix and hospital utilization

The severity of patients treated in hospitals increased steadily from 1980 through 1985 (Farley, 1988). This is supported by HCFA data showing a 14-percent increase in the number of intensive care and coronary care unit (ICU/CCU) patient days reported nationally from 1983 to 1986 (HCFA, 1988). Data from the AHA HNPS indicate that a majority of hospitals also reported an increase in average levels of patient acuity over the 12 months of 1987. This increase in casemix severity coincides with shorter average lengths of stay. Together, these two trends imply greater intensity of nursing care. Sicker patients and shorter stays may mean an increased requirement for RNs on evening and weekend shifts, which are traditionally difficult time periods to staff with full nursing coverage. The cause and effect relationship between the range of nursing shortages reported and variation in rates of hospital utilization is far from obvious. The rise in hospital employment of RNs has been occurring during unprecedented declines in hospital utilization. Even large increases in the average severity of patients treated in the hospital have not fully offset the significant declines in length of stay (Farley, 1988). In fact, Aiken and Mullinix (1987) argue that "the average condition of hospitalized patients has not changed enough to require a 26 percent increase in the ratio of registered nurses to patients."

II. METHODOLOGY

A. OVERVIEW

The objectives of this study were to assess the extent of nursing shortage and to determine the relationship, if any, between selected hospital characteristics and specific measures of nursing shortage. The following analysis groups hospitals into low and high shortage categories according to three nursing shortage measures and compares differences in other characteristics of these hospitals. The analysis also examines the change in behavior between high and low shortage hospital groups in the 2 years following a hospital's classification as a high or low shortage hospital.

B. DATA SOURCES

The scope and complexity of current reports of nursing shortages prevent any one data source from yielding definitive answers to these questions. However, the Hospital Studies Program (HSP) at the National Center for Health Services Research and Health Care Technology Assessment (NCHSR) maintains a number of data bases on short-term, general non-federal hospitals that can contribute a range of useful estimates. Three basic data sources were used for this analysis:

1. American Hospital Association (AHA) Annual Survey data from 1982, 1984, and 1986;

2. Hospital Cost and Utilization Project (HCUP) data from 1982, 1984 and 1986; and

3. AHA Hospital Nursing Personnel Survey (HNPS) data from April 1987 (HNPS 1987).

The AHA Annual Survey compiles information on hospital utilization, ownership, accreditation, and financial indicators from over 6,000 of the nation's short-term general non-federal hospitals (STGHs). The Hospital Cost and Utilization Project (HCUP), a component of NCHSR's Hospital Studies Program (HSP), maintains a database of information on over 600 United States hospitals. The HCUP-2 data base covers the period 1980 to 1986 and contains AHA survey information, including confidential financial data, and all discharge abstracts from participating hospitals. Characteristics of local areas are also available for HCUP-2 hospitals from the Area Resource File.

The third data source is the AHA 1987 HNPS. This survey was administered to a 20 percent sample (N=1200) of the approximately 6,000 hospitals participating in the AHA Annual Survey of Hospitals. In addition to specific questions on nursing shortage, recruitment, and employment, the HNPS also obtained information on nursing budgets, staffing, and nursing care delivery systems. In general, HNPS hospitals have characteristics which are comparable to those of other U.S. hospitals (see Appendix, Table A1). Among HNPS hospitals, no significant differences exist with respect to ownership, location, nurse-to-patient ratio, nursing percentage of total hospital budget, percentage of Medicare patients and number of live births. Statistically significant differences were small in size and thus are not a major impediment to generalizing from the HNPS sample to U.S. hospitals. Among HNPS hospitals, these latter variables include hospital size, medical school and nursing school affiliation, salary expenses per RN, length of stay and intensive care unit (ICU) days.

Data from these sources were compiled and analyzed by NCHSR, and Appendix Tables A1 through A8 contain the full results of these analyses. As indicated in the table endnotes, and described in Section D, Selected Hospital Characteristics, the number of observations used from each of the three sources varies according to availability of data for both shortage measures and hospital/market characteristics.

C. SHORTAGE MEASURES

The three shortage measures in this report include two objective measures--full-time budgeted RN vacancy rate (vacancy rate) and full-time equivalent RNs per 100 inpatient days (RNs per 100 days)--and a subjective assessment of RN shortage as reported by nursing supervisors or hospital administrators; the latter can be defined as the perceived severity of shortage. There are two reasons for using multiple measures of shortage. The first relates to the subjective nature of the shortage concept: multiple measures help to capture different dimensions of the concept. The second involves data availability: only RNs per day, the most indirect measure of shortage used here, was available for the entire time covered by the analysis.

1. Vacancy Rate

A "nursing shortage" has been defined in the literature as a relatively high budgeted RN vacancy rate, although no threshold value has been established to identify the occurrence of a shortage (Aiken and Mullinix, 1987). For this study, "vacancy rate" was defined as the fraction of budgeted, full-time equivalent (FTE) RN positions reported as unfilled by hospitals. Vacancy data were available for 1982 and 1984 from the AHA Survey, but not for 1986.

Using the vacancy rate as a measure of shortage has several disadvantages. It does not account for the number of contract nurses (per diem RNs) or temporary agency nurses employed by hospitals. Thus, it may overstate the actual vacancy rate as measured by unfilled nursing shifts. In addition, to the extent that RN positions must be budgeted in order to be counted as vacant, the budgeted vacancy rate may understate unmet or "silent" demand for nurses by failing to count positions which are not budgeted. Finally, vacancy rate does not take into account the proportion of RNs engaged in bedside patient care or the appropriateness of RN utilization. These factors may also lead the vacancy rate to over-report vacancies for bedside nurses. However, this rate has been reported intermittently within the hospital industry for many years and thus offers a readily available source of data which specifically identifies unmet hospital demand for RNs.

Nursing vacancy rates have undergone cyclical shifts since 1950. The most recent shortage occurred in 1979, and from 1979 to 1983 the RN vacancy rate declined steadily from 14.0 percent to 4.4 percent. Since 1983, there has been a renewed steady rise in this rate to 11.3 percent in 1987 (AHA, December 1987). Reports of shortages increased rapidly in 1986 and have remained high in subsequent reports (AHA, December 1987; Rountree, in press). The present analysis may not fully reflect shortage factors to the extent that conditions have changed since these data were collected.

2. RNs Per 100 Patient Days

FTE RNs per 100 inpatient days offers a standardized measure of actual hospital employment of RNs. This measure indicates relative shortage to the extent that low rates result from an inability to hire RNs compatible with patient census. In addition, it takes into account demand factors related to patient census. However, the measure does not reflect unmet demand and thus cannot be related directly to shortage due to differences in staff mix and severity of case mix. Like other shortage measures, it does not account for the proportion of nurses engaged in patient care or the appropriateness of RN utilization. Some hospitals with low RNs per 100 days may have less need for RNs or may substitute less skilled personnel for RNs and may not demand additional RNs. Other hospitals may continue to hire additional RNs while reporting shortages. However, this rate is a direct indication of RN use and correlates to some extent with other measures of RN shortage. In addition, these data are more consistently reported by hospitals to the AHA than are other shortage measures and are available for the years 1982, 1984, and 1986.

3. Perceived Shortage

Data regarding the perceived severity of shortage, as reported by the nursing supervisor or hospital administrator, were analyzed as a third measure of shortage. The severity of shortage reported may overstate the extent of shortage because it does not account for appropriateness of RN utilization and is not limited by budget constraints.

The degree of RN shortage perceived by nursing supervisors and hospital administrators was reported by hospitals surveyed in the 1987 HNPS by the American Hospital Association (AHA, April 1987). Hospitals which reported that they were experiencing "no" or "mild" shortage in April 1987 were defined as "mild" shortage

hospitals (46 percent of reporting hospitals) while hospitals which reported "moderate" or "severe" shortages were defined as "severe" shortage hospitals (54 percent of reporting hospitals).

D. SELECTED HOSPITAL CHARACTERISTICS

Characteristics of data base hospitals known to be associated with staffing patterns were selected and the relationships between these characteristics and the three shortage measures of interest were analyzed on a cross-sectional basis and over time. Selected characteristics include the following:

- Bedsize
- Ownership
- Geographic location
- Urban location
- Medical/nursing school affiliation
- Nursing expenses
- Nurse staffing data
- Percentage Medicare indicators
- Casemix index, length-of-stay (LOS) weighted
- Length of stay, adjusted for casemix
- Aggregate utilization data
- Hospital financial indicators

Most of these characteristics were measured from responses to the AHA Annual Survey and, therefore, were available for all U.S. community hospitals. However, casemix and financial information were only available for HCUP-2 hospitals. Therefore, the casemix index, casemix-adjusted length of stay and certain financial measures are based only on HCUP-2 data. The practical importance of this difference in data sources primarily involves sample size, as discussed below.

The basic analytical approach used in this analysis can be described as follows. Hospitals were first divided into distinct categories based on the degree of shortage they displayed. For the two objective measures, RNs per 100 days and vacancy rates, the universe of hospitals was divided into three groups representing increasing levels of shortage severity. This three-part categorization was then reduced to the two extremes by eliminating the middle group from the analysis. Two groups were developed directly from the subjective measure of shortage. One group consisted of all hospitals indicating that they either had no shortage in 1987 or had only a mild shortage. The other group contained hospitals reporting either a moderate or severe shortage. Hospitals reporting a zero vacancy rate were excluded on the assumption that zero vacancies probably reflect a failure to budget for personnel positions rather than a true indication of complete staffing.

Selected characteristics of hospitals were then compared between various "low" and "high" shortage groups. In general, the analysis for the objective measures of shortage involved concurrent classification and characteristics. That is, for example, 1984 vacancy rate data were used to classify hospitals and these categories were then used

to compare characteristics in 1984. In contrast, the subjective measure of shortage was only available for 1987. In this case, separate comparisons of hospital characteristics were performed on 1982, 1984 and 1986 data using the 1987 HNPS data to categorize hospitals.

In addition to the bivariate analyses presented here, separate multivariate regressions were estimated to analyze the effects of selected hospital characteristics holding other factors constant. In general, these regressions were more successful in explaining nursing employment levels than vacancy rates. Because the multivariate results did not differ substantially from the bivariate results, only the latter are reported in this discussion.

In general, Tables A2-A8 can be grouped by the types of relationships examined. Most of the selected hospital characteristics listed above were included in all analyses. Where results are unreported in these tables, necessary data were not available.

Tables A2, A3, A4, and A5 present results of the calculation of cross-sectional, bivariate relationships between selected hospital characteristics and each of the three shortage measures, using data for the three years 1982, 1984, and 1986. Table A2 contains data for the first shortage measure, vacancy rate, for the years 1982 and 1984. Table A3 contains data for the second shortage measure, RNs per 100 patient days for the years 1982, 1984, and 1986. Table A4 relates perceived shortages in 1987 to characteristics of hospitals that do not vary over time (e.g., region of location). Table A5 relates perceived shortages in 1987 to time-varying characteristics observed in 1982, 1984 and 1986.

The second group of tables (A6, A7, and A8) examines the relationships between apparent hospital responses to shortages, as indicated by changes in selected hospital characteristics and the three shortage measures. These tables contain data on cross-sectional, bivariate relationships between the three shortage measures and changes in the selected characteristics for the periods 1982-1984 and 1984-1986. Tables A6 and A7 summarize these data for the vacancy rate and RNs per day, respectively. In both, the shortage measure reported in 1982 is related to changes in hospital characteristics for the period 1982-1984, and the shortage measure reported in 1984 is related to changes in hospital characteristics for the period 1984-1986. Table A8 summarizes these data for the measure of perceived shortage as reported in the April 1987 HNPS, related to changes in hospital characteristics for the same periods (1982-1984 and 1984-1986). A set of illustrative tables (A-F), which follow in the text, summarizes these specific measures and their relationship to specific variables in context. Note that in these tables, the perceived shortage groups (mild/severe) are labelled "low/high," as used for Measures 1 and 2.

The number of observations used to calculate the means in Tables A2-A8 varies greatly, based upon the availability of data. The following table provides basic guidance about the average number of observations in each shortage "group" (e.g., low or high) for particular combinations of years, shortage measures, and data sources. Total numbers of observations available for these analyses were roughly three times the counts given below for the measures RNs per 100 patient days and for AHA vacancy rates; they were roughly twice the counts given for the measure perceived shortage reported on the 1987 HNPS.

Shortage measure	AHA Variables			HCUP Variables		
	1982	1984	1986	1982	1984	1986
RN vacancy rates	860	730	n.a.	90	65	n.a.
RNs per 100 patient days	1360	1300	1320	120	70	139
Perceived shortage (1987 INPS)	275	275	275	27	29	25

E. LIMITATIONS OF THE DATA AND SCOPE OF THE ANALYSIS

As noted, the data presented in this report refer to the short term, non-federal hospital sector only. This hospital sector comprises the bulk of all acute care hospitals in the country and employs nearly 70 percent of all nurses (Moses, 1986, as quoted in U.S. DHHS, 1988), offering a fairly wide range of nursing demand across the range of patient care tasks. The following data thus represent a large and crucial sector of patient care but cannot assess nursing supply and demand in long-term institutional care (HCFA, 1987), in ambulatory care other than the outpatient hospital or clinic sector, or in public health or home health nursing, where the growing provision of services will make the need for registered or otherwise trained and licensed nurses a major concern (HCFA, personal communication, 1988). The inability to include the entire nursing sector is balanced, however, by the availability of detailed data with a good degree of generalizability (see Table A1 for a comparison of the present data set and the universe of short-term general hospitals in the U.S.).

The second point of note in interpreting the findings of this report is the fact that the three nursing shortage measures used are examined both over time and across different distributions of hospitals for each year of data availability. Thus, the factors affecting or related to nursing demand can be assessed on a cross-sectional basis and, to a limited degree, over time. More importantly, the measures permit analyzing data on factors related to nursing shortages for objective and subjective aspects of shortage. Although these may be expected to have some degree of intercorrelation, they encompass different aspects of hospital resource use and staffing patterns and, in the case of the ratio of RNs to patient days, reflect not only internal staffing preferences but some measure of patient need as reflected in hospital utilization.

RN vacancy rates (in terms of unfilled budgeted positions) have been reported by short-term hospitals for a number of years and offer a direct shortage measure. However, it is a measure subject to over- or under-reporting of shortages because of a range of factors entering the budgeting process, such as the preferred ratio of RNs to LPNs, or for reliance on full-time rather than contract or temporary staff. Also, as noted, the inclusion of budget slots does not necessarily reflect the actual allocation of resources for filling these slots.

The number of RNs per 100 patient days has the advantage of requiring actual expenditures on hiring RNs rather than merely budgeting positions. It also indicates the actual use of services, and hospitals with a higher ratio of RNs per patient day may be viewed as having a smaller shortage than hospitals with lower ratios, all things being equal. On the other hand, other things rarely are equal and the ratio of

nurses to patient days may thus reflect differences in casemix, teaching status, or use of RNs for tasks other than patient care. Also, differences among hospitals on this measure may be largely a function of traditional hiring patterns and fail to take into account the substitution of other nursing staff. Thus, this ratio is an indirect or proxy measure and, as indicated, may be inversely related to shortage. Both in theory and practice it provides a useful basis of comparison with other shortage measures.

The third measure, a perceived RN shortage, reflects the subjective evaluation of nursing directors or hospital administrators. While this measure may well be criticized for its subjective nature, it is less sensitive to under-reporting of shortages due to budget constraints and thus serves to offset the potential drawbacks of basing comparisons only on the budgeted vacancy rate.

A fourth potential measure, not addressed in these data but available in the AHA Nursing Surveys (AHA, April 1987, and December 1988), is recruiting time, which reflects the degree of difficulty encountered in filling budgeted slots. Since this measure cannot be analyzed in detail, based on the data available in these reports, findings based on it must be excluded for lack of comparability.

III. FINDINGS

A. COMPARISON OF NURSING SHORTAGE MEASURES

The interrelationship of the three shortage measures used is shown in Table A, which presents hospitals assigned to high or low RN shortage groups for 1982, 1984, and 1986 (where available), by whether the shortage measure was based on reported RN vacancies, the rate of RNs/100 inpatient days, or a perceived nursing shortage as reported in the 1987 AHA HNPS.

Table A: Comparison of Shortage Measures for Registered Nurses in Short-Term Non-Federal Hospitals

Nursing Shortage Measure	1982 Low	1982 High	1984 Low	1984 High	1986 Low	1986 High
Measure 1: RN Vacancy Rate						
Vacancy rate for RNs	.028 **	.149	.024 **	.107	n.a.	
FTE RNs per 100 inpatient days	.269 **	.213	.303 **	.276	n.a.	
Percent reporting shortage (1987)	76.2	79.2	72.9 **	88.9	n.a.	
Measure 2: RNs/100 Patient Days						
Vacancy rate for RNs	.039 **	.060	.033	.031	n.a.	
FTE RNs per 100 inpatient days	.341 **	.140	.388 **	.175	.480 **	.226
Percent reporting shortage (1987)	77.6	74.3	77.0	75.9	72.6	76.6
Measure 3: Perceived RN Shortage						
Vacancy rate for RNs	.052 *	.072	.034	.047	n.a.	
FTE RNs per 100 inpatient days	.235	.244	.273	.284	.350	.349
Percent reporting shortage (1987)	48.3 **	100	48.3 **	100	48.3 **	100

* P<.05; ** P<.01.
n.a. = not available.

The three measures relate to one another as expected where the results are statistically significant with low and high rates from one measure corroborating low and high rates from the other (allowing, of course, for the inverse relationship between shortage and RNs per day). However, perceived shortage and RNs per day exhibit no interrelationship. Examining these measures across time, for Measure 1 (the vacancy rate) the difference between low and high shortage hospitals decreased between 1982 and 1984. For Measure 2, the RN rate/100 patient days, the difference remained stable, despite a rise in the rate for both shortage groups. Measure 3, the 1987 perceived RN shortage, would appear both the strongest and the least discriminating measure: It leaves little distinction between high and low shortage hospitals with regard to the two objective measures, while indicating that even among hospitals reporting no or only a mild shortage in 1987, nearly half did in fact perceive some shortage.

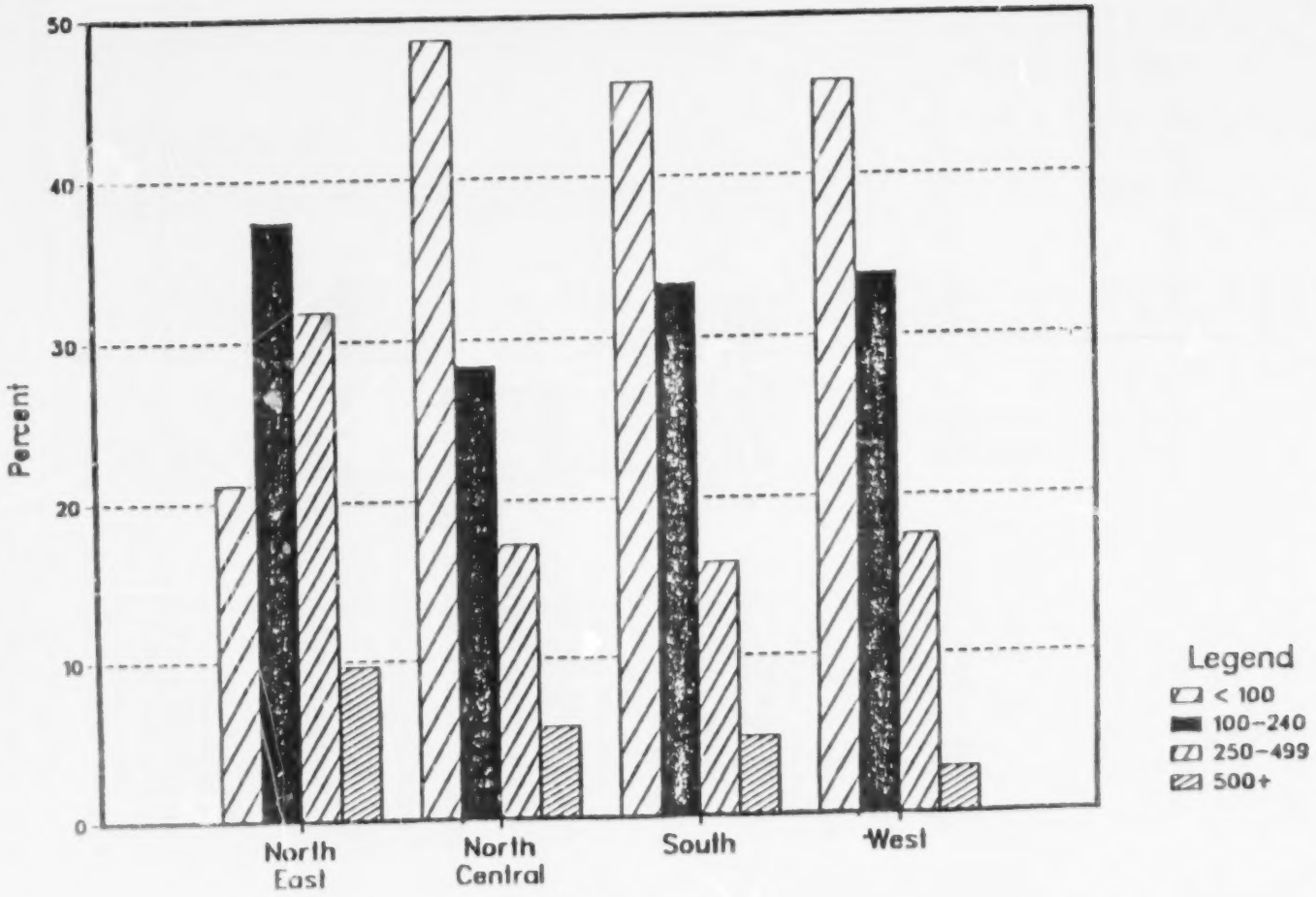
B. THE GEOGRAPHIC DISTRIBUTION OF NURSING SHORTAGES

Based on hospital classification by Measures 1 and 2 (vacancy rates and nurse/patient day rates), by far the largest percentage of hospitals with high nursing shortages were located in the South. The West ranks lowest, regardless of whether this classification applies to 1982-1984, years of relatively low shortages nationally, or to 1986 as a relatively high shortage year. For Measure 2, this is true also for the bed size, with small hospitals (less than 100 beds) consistently making up the largest percentage of high shortage hospitals. (Note that small hospitals predominate in all regions of the country except the Northeast; see Figure 1.) In terms of bed size, hospitals in the medium-to-high range (250 beds and over) appear least likely to experience a shortage, at least in terms of the ratio of nurse-to-patient days. By contrast, using Measure 3, the shortage assumes a very different pattern, i.e., it is more acute in the Northeast and among large (500+ beds) hospitals. It is clear even from these very general findings that the three available shortage measures capture different aspects of shortage (see Table B).

This is also observed for hospital location (shown as the percent of high and low shortage hospitals located in urban areas), where despite relative differences between the measures, and a reversal starting in 1984, Measures 1 and 2 show fewer shortages in urban than in other areas. A very different pattern is seen for Measure 3 (shown only for 1986 hospital characteristics). More specifically, the reported vacancy rate indicates a substantial increase in the percentage of urban hospitals with a high RN shortage (from 56 percent in 1982 to 73 percent in 1984, the low shortage year), while Measure 2 (RNs/inpatient days) allocates only a third to two fifths of urban hospitals to the high shortage category. Self-reporting of the severity of the nursing shortage in 1987 here clearly follows the pattern of the vacancy rate.

FIGURE 1

Distribution of Hospitals Across Bedsize Categories, by Census Region, 1986



Source: Compendiums provided by the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, HHS.
American Hospital Association

Table B: Hospital Location and Size

Nursing Shortage Measure	1982 Low		1982 High	1984 Low		1984 High	1986 Low		1986 High
Measure 1: RN Vacancy Rate									
Percent distributions by									
Census Region									
Northeast	21.9	**	16.5	17.8	**	22.9	n.a.		
Northcentral	30.2	**	24.1	29.7	**	23.2	n.a.		
South	27.0	**	47.8	31.7	**	38.7	n.a.		
West	21.0	**	11.5	20.7	**	15.1	n.a.		
Bedsize									
<100 beds	22.6	**	29.5	29.6	**	18.7	n.a.		
100-249 beds	38.0		38.9	39.6	**	31.0	n.a.		
250-499 beds	30.0	**	23.5	23.3	**	39.2	n.a.		
500 + beds	9.4		8.1	7.5	*	11.2	n.a.		
Percent urban location	69.5	**	55.9	66.8	*	73.0	n.a.		
Measure 2: RNs/100 Patient Days									
Percent distributions by									
Census Region									
Northeast	22.3	**	6.2	16.8	**	10.0	13.9		15.0
Northcentral	25.7	*	29.7	30.9		29.5	35.2	**	25.5
South	17.3	**	60.3	15.9	**	57.2	18.8	**	55.0
West	34.7	**	3.8	36.4	**	3.3	32.1	**	4.5
Bedsize									
<100 beds	28.1	**	55.0	33.2	**	49.6	37.7	**	44.6
100-249 beds	33.5		32.0	32.4		33.9	34.0		33.3
250-499 beds	27.6	**	10.9	25.1	**	13.2	32.2	**	17.8
500 + beds	10.8	**	2.1	9.3	**	3.3	6.1	*	4.3
Percent urban location	69.0	**	31.8	67.1	**	35.8	62.3	**	42.6
Measure 3: Perceived RN Shortage									
Percent distributions by									
Census Region									
Northeast	12.3	**	24.3	12.3	**	24.3	12.3	**	24.3
Northcentral	32.6		25.3	32.6		25.3	32.6		25.3
South	36.0		33.9	36.0		33.9	36.0		33.9
West	19.1		16.4	19.1		16.4	19.1		16.4
Bedsize									
<100 beds	47.0	**	28.0	47.0	**	28.0	47.0	**	28.0
100-249 beds	32.2		33.2	32.2		33.2	32.2		33.2
250-499 beds	18.2	**	28.0	18.2	**	28.0	18.2	**	28.0
500 + beds	2.5	**	10.9	2.5	**	10.9	2.5	**	10.9
Percent urban location	46.2	**	63.8	46.2	**	63.8	46.2	**	63.8

* P<.05; ** P<.01.
n.a. = not available.

C. HOSPITAL STRUCTURE

In terms of hospital structural characteristics, where the uneven regional distribution of hospital ownership is an important consideration (see Figure 2), a shift from the low to the high-shortage category for private, not-for-profit hospitals is observed (see Table C). Public hospital have historically been affected by staff shortages, but this shift, as indicated by all three shortage measures (restricted to 1986 for Measure 3), reflects a narrowing of the difference in RN shortages between private hospitals and public hospitals. This trend is one of the more interesting findings from these data, but must be examined in the context of other factors such as budget constraints and reimbursement changes, that cannot be taken into account here. For instance, hospitals may differ in their flexibility to budget for RN positions and these differences may be related to type of ownership.

FIGURE 2

Distribution of Hospitals Across Types of Ownership, by Region, 1986

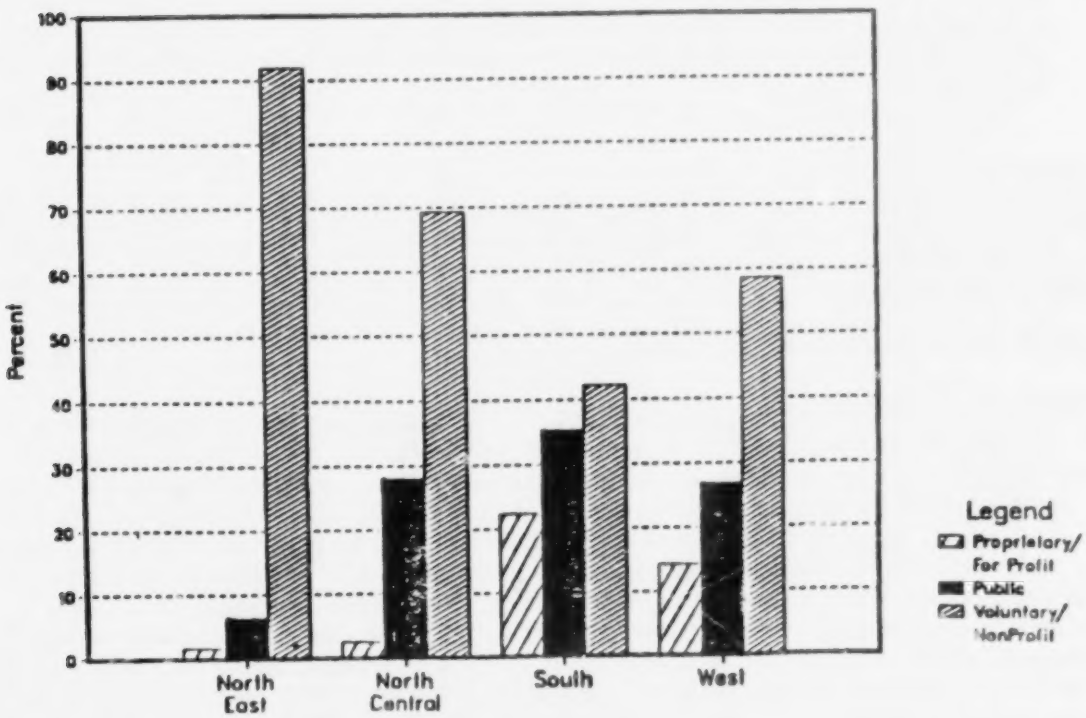


Table C: Hospital Ownership and Teaching Status

Nursing Shortage Measure	1982 Low		1982 High	1984 Low		1984 High	1986 Low		1986 High
Measure 1: RN Vacancy Rate									
Percent distribution									
Public	11.6	**	37.6	15.9	**	27.8	n.a.		
Private, not-for-profit	77.8	**	54.9	67.0		67.3	n.a.		
Private, investor-owned	10.6	*	7.5	17.0	**	4.9	n.a.		
Percent with									
Medical School aff.	19.6		19.3	16.9		31.7	n.a.		
Member, COTH	7.8		8.8	7.1	**	16.1	n.a.		
Nursing School	8.6		6.8	6.1	**	11.2	n.a.		
HMO relationship	26.2	**	19.2	33.5		35.6	n.a.		
Measure 2: RNs/100 Patient Days									
Percent distribution									
Public	19.3	**	41.8	21.8	**	36.4	21.6	**	32.4
Private, not-for-profit	72.9	**	46.4	69.9	**	51.5	68.7	**	55.8
Private, investor-owned	7.8	**	11.8	8.3	**	12.1	9.8		11.9
Percent with									
Medical School aff.	26.0	**	4.6	24.1	**	7.8	20.3	**	11.0
Member, COTH	12.3	**	1.0	12.8	**	1.5	11.2	**	3.2
Nursing School	8.7	**	3.0	7.5	**	3.5	5.9		4.7
HMO relationship	30.6	**	7.1	41.3	**	13.7	57.4	**	33.9
Measure 3: Perceived RN Shortage									
Percent distribution									
Public	27.1	*	18.4	27.1	*	18.4	27.1	*	18.4
Private, not-for-profit	65.3		73.4	65.3		73.4	65.3		73.4
Private, investor-owned	7.6		8.2	7.6		8.2	7.6		8.2
Percent with									
Medical School aff.	11.0	**	22.4	13.6	**	24.3	13.1	**	25.3
Member, COTH	4.7	**	11.5	4.7	**	12.5	4.7	**	11.8
Nursing School	5.9		8.2	5.9		7.9	4.2		6.9
HMO relationship	16.2		22.0	20.8		30.3	39.7	*	51.7

* P<.05; ** P<.01.
n.a. = not available.

Other structural factors, such as medical or nursing school affiliation or membership in the Council of Teaching Hospitals (COTH), are less clearly related to shortage than ownership status. There is an increase in the percentage of high-shortage hospitals with these affiliations, but it is substantial for the vacancy rate measure only during the low shortage period (1984), while the nurse/patient day rate allocates a far larger share of hospitals to the low shortage group. Here again, the percentage of high-shortage hospitals with these affiliations, but it is substantial for the vacancy rate measure only during the low shortage period (1984), while the nurse/patient day rate allocates a far larger share of hospitals to the low shortage group. Here, again, the perception of shortage severity (Measure 3) provides a quite different ranking, with teaching status (and HMC affiliated) hospitals more frequent in the high-shortage group. Again, the evidence points to a relation between shortage and structural characteristics that is reflected in but not explained by the shortage measures used here.

D. NURSING SALARIES

The difference between high and low shortage hospitals in terms of the proportion of nursing salaries, both as a percent of total salaries and of total hospital expense, remains stable and small across all three shortage measures from 1982 to 1986 (see Table D). (Proportional expenses on nursing staff constitute a better measure than absolute salary levels, which can be confounded by regional differences and inflation.) Clearly, differences in relative nursing expenditures do not explain differences between high and low shortage hospitals. While hospital nursing expenditures relative to other hospital expenditures thus must be discounted as an explanation, they could be an important part of the remedy.

E. STAFF MIX

The two objective measures of shortage are significantly related to the composition of hospital nursing staffs (Table D). Based on the ratio of LPNs and LVNs to RNs (all as full-time equivalents) hospitals with high shortages consistently employed relatively more LPNs than low shortage hospitals. However, the ratio of LPNs and LVNs to RNs employed in hospitals declined substantially from 1982 to 1986 for both shortage groups.

Interestingly, the ratio of LPNs and LVNs to RNs is not very sensitive to Measure 3, the perception of nursing directors and administrators. The reported nursing shortage may, therefore, reflect not so much an absolute shortage of patient care staff as an increased demand for more highly trained (and not notably better paid) staff. An increase in the demand for registered nurses associated with a decline in the demand for LPNs and LVNs could occur for technological or economic reasons. Hospitals may demand more highly trained staff to deal with a patient population that is more severely ill, on average, and receiving care in shorter, more intensive stays. They may also demand more RNs--and fewer vocational nurses--because of changes in relative salaries. Neither of these possibilities can be explored with data available here.

Bed staffing rates (FTE RNs/100 short-term beds) increased mainly in the high shortage group, with Measure 2 (RNs per 100 patient days) showing a large and persistent difference across all three data points (see Table D); this difference is much smaller when hospitals are grouped by Measure 3, again indicating the need for more specific indicators underlying what is clearly a general perception of shortage (Commonwealth Fund, report in preparation).

Table D: Staffing Ratios and Relative Nursing Salaries

Nursing Shortage Measure	1982 Low	1982 High	1984 Low	1984 High	1986 Low	1986 High
Measure 1: RN Vacancy Rate						
FTE RNs per 100 short-term beds	71.8 **	54.2	70.0	69.0	n.a.	
FTE LPNs and LVNs/RNs	.411 **	.701	.379 **	.444	n.a.	
Nursing salaries as percent of						
Total hospital expense	17.3 **	16.6	17.2 *	16.8	n.a.	
All salaries	35.9 **	34.5	37.1 **	34.7	n.a.	
Measure 2: RNs/100 Patient Days						
FTE RNs per 100 short-term beds	83.9 **	33.2	83.3 **	38.1	89.1 **	45.6
FTE LPNs and LVNs/RNs	.299 **	.981	.251 **	.810	.221 **	.681
Nursing salaries as percent of						
Total hospital expense	17.6 **	16.6	17.4 **	16.9	n.a.	
All salaries	36.2 **	35.0	36.7 *	36.1	n.a.	
Measure 3: Perceived RN Shortage						
FTE RNs per 100 short-term beds	57.1	62.6	59.1 *	66.1	66.6 **	73.3
FTE LPNs and LVNs/RNs	.612	.560	.473	.446	.428 *	.356
Nursing salaries as percent of						
Total hospital expense	17.3	16.8	17.3	17.2	n.a.	
All salaries	35.9 *	34.3	36.6	35.8	n.a.	

* P<.05; ** P<.01.
n.a. = not available.

F. CASEMIX AND HOSPITAL UTILIZATION

The severity of hospital caseloads for all types of patients is summarized by the casemix index (Table E), which is standardized to the average casemix found in HCUP-2 hospitals overall. The index shows that while casemix severity has been rising over the period 1982 to 1986 for both low and high shortage hospitals, there is no difference in this respect between these two groups of hospitals. This casts doubt on the argument that nursing shortages have been stimulated by increasing patient acuity.

The relationship between the concentration of Medicare inpatients and RN shortages is inconclusive from the three shortage measures. While Measure 2, RNs per day, shows high shortage hospitals with significantly higher proportions of Medicare patients for all time periods, the other two shortage measures show high shortage hospitals treating fewer Medicare patients. Length of stay (LOS) adjusted for casemix is weakly related to high levels of shortage (see Table E). It is open to question whether the pattern of high costs per admission (adjusted for volume of total hospital outpatient visits), which are found in the low shortage category for both Measures 1 and 2, and in the high shortage category for the measure of perceived nursing shortage (Table F), reflects differences in the nature of hospital admissions or the efficiency with which admissions are treated (Luft and Robinson, 1988). Finally, there is clearly no discernible relationship between overall hospital profitability and high and low nursing shortages.

Table E: Casemix and Length of Stay

Nursing Shortage Measure	1982 Low	1982 High	1984 Low	1984 High	1986 Low	1986 High
Measure 1: RN Vacancy Rate						
Percent Due to Medicare						
Revenues[a]	37.2	38.0	38.7	40.4	n.a.	
Inpatient days	44.1	43.4	45.7 **	43.7	n.a.	
Admissions	32.7	33.1	35.2 **	33.6	n.a.	
Casemix adjusted average LOS[a]	6.76	7.00	5.61 **	6.23	n.a.	
Casemix index[a]	1.00	0.97	1.04	1.05	n.a.	
Measure 2: RNs/100 Patient Days						
Percent Due to Medicare						
Revenues[a]	36.6 **	42.3	36.4 **	41.7	39.8 **	42.8
Inpatient days	41.7 **	47.5	42.1 **	47.2	42.2 **	45.6
Admissions	31.6 **	37.2	34.3 **	39.2	34.9 **	39.0
Casemix adjusted average LOS[a]	6.45	6.42	4.75 **	5.52	4.82 **	5.24
Casemix index[a]	1.00	0.98	1.00	1.01	1.09	1.06
Measure 3: Perceived RN Shortage						
Percent Due to Medicare						
Revenues[a]	36.3	39.2	38.1	40.2	39.8	39.8
Inpatient days	45.1	43.2	45.7	44.8	44.3	44.4
Admissions	34.8 *	33.0	37.2 *	35.3	37.1 *	35.5
Casemix adjusted average LOS[a]	6.53	7.07	5.44	5.77	5.16	5.24
Casemix index[a]	0.98	0.98	1.01	1.02	1.06	1.07

* P<.05; ** P<.01.
n.a. = not available.
[a] This variable is only available for hospitals in the HCUP-2 sample.

Table F: Costs Per Admission and Hospital Operating Surplus

Nursing Shortage Measure	1982 Low	1982 High	1984 Low	1984 High	1986 Low	1986 High
Measure 1: RN Vacancy Rate						
Costs per adjusted admission[a]	$2,184 **	$1,994	$2,596	$2,644	n.a.	
Operating surplus as a percent of expenses[b]	4.19	3.69	5.79	4.48	n.a.	
Measure 2: RNs/100 Patient Days						
Costs per adjusted admission[a]	$2,378 **	$1,575	$2,844 **	$1,934	$3,132 **	$2,413
Operating surplus as a percent of expenses[b]	3.54	4.02	5.18	5.17	4.20	4.21
Measure 3: Perceived RN Shortage						
Costs per adjusted admission[a]	$1,876 **	$2,159	$2,245 **	$2,596	$2,670 **	$3,025
Operating surplus as a percent of expenses[b]	3.98	1.83	5.78	6.46	4.91	4.53

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* P<.05; ** P<.01.
n.a. = not available.
[a] Adjustment for total hospital outpatient use volume.
[b] This variable is only available for hospitals in the HCUP-2 sample.

G. HOSPITAL RESPONSES OVER TIME TO RN SHORTAGES

An examination of statistically significant changes in hospital characteristics and their direction over time (Appendix Tables A6 to A8) serves as much to highlight known hospital trends as to illustrate the appropriateness of the three shortage measures available for this analysis. Measure 1 (the RN vacancy rate; Table A6), indicates that high shortage hospitals experienced a greater decrease in beds following the introduction of prospective payment for Medicare admissions than low shortage hospitals, accompanied by an increase in the number of RNs per bed. Measure 2 (Table A7) indicates that high shortage hospitals in fact increased their RN ratio per bed (as well as per inpatient day).

As noted, high shortage hospitals also experienced a greater drop in the LPN and LVN to RN ratio in both two year periods. These results indicate that high shortage hospitals increased their reliance on RNs more than low shortage hospitals, possibly aggravating an already tight staffing situation.

The moderate to severe nursing shortage reported by more than half of AHA hospitals in 1987 (HNPS, 1987) thus may well be described as a shortage due to high demand rather than short supply of registered nurses. In turn, the increasing demand for RNs appears to reflect a shift in preferred staffing patterns more than an increase in the overall demand for nursing services. This finding is consistent with evidence from other sources, such as the estimates of nursing supply reported in the 6th Annual Report to the President (U.S. DHHS 1988).

A surprising finding from Tables A6-A8 is that high shortage hospitals did not increase nursing salaries as a percent of total hospital expense in the two years following their relatively high shortage in 1982. In fact, high shortage hospital raised salaries less than low shortage hospital according to all measures. The classic market solution for eliminating shortage apparently has not been tried by the hospital industry. Unfortunately, the available empirical evidence is scant, since AHA salary information does not distinguish between RNs and LPNs/LVNs and was available only through the low shortage year 1984.

IV. SUMMARY AND CONCLUSIONS

The foregoing analysis suggests a number of findings which are summarized in the following:

- Recent nursing shortages appear to have been largely induced by greater hospital demand for RNs, despite a steady increase in RN supply. In general, hospitals have continued to increase their employment of RNs per patient day and to increase budgeted RN vacancies.
- Hospitals have not increased the proportion of budgets allocated to nursing services. As a standardized measure of nursing salary expenses, a stable budget allocation to nursing departments suggests that relative nursing salaries have not increased, particularly in view of increases in the ratio of RNs to patient days.
- Increased demand for RNs appears to be related to, among other things, greater reliance of hospitals on RNs relative to LPNs. The ratio of LPNs to RNs has declined steadily since 1982. High shortage hospitals, in particular, used RNs to replace LPNs.
- Nursing shortages do not appear to have adversely affected, or to have been affected by, hospital profitability, on average. Hospital operating surpluses increased between 1982 and 1986 for both low and high shortage hospitals with no significant differences between the two groups in any year.
- Average severity of diagnostic casemix has increased steadily among all types of hospitals. However, increases in casemix severity were comparable between high shortage and low shortage hospitals, suggesting that casemix differences do not account for shortage differences.

These conclusions neither prove nor disprove the existence of a nursing shortage, but rather suggest the need for measures that would illuminate the foregoing discussion. A number of conclusions merit further investigation. The strength, and lack of discrimination among high and low shortage hospital, of the measure of perceived shortage severity is of interest and raises a number of questions that relate to the intended use of registered nurses in a competitive hospital environment. The apparent absence of an increase in nursing salaries relative to total hospital expense is another aspect worthy of note. The perception of a nursing shortage exists across nearly all short-term hospitals. Clearly this perception is stronger among certain parts of the industry (such as large, urban, northeastern teaching hospitals). Yet there is considerably less variation in the perception than there is in actual nursing intensity or in vacancy rates. Perceived shortage levels do not correspond closely to RN employment levels.

While the nursing shortage may have increased in recent years, it did so in spite of the fact that hospitals employed nearly 50 percent more RNs per patient day in 1986 than in 1982. The results also suggest that the relative use of alternative nursing resources (LPNs, contract RNs, and part-time RNs) declined over this period. While hospitals to some extent appear to use LPNs to compensate for difficulties in hiring RNs, a general shift in employment patterns, with hospitals moving away from other nursing personnel in favor of registered nurses, seems to be an important factor in explaining the generally perceived shortage of registered nurses.

Available data and methods limit the inferences which can be drawn from this analysis. One important limitation relates to the time period covered by the data used in these analyses. While hospital responses to shortage are described as changes over the period 1982-1986, only in 1986 did the issue of the recent shortage surface.

Thus, some of the results presented here pertain to hospitals facing different levels of nursing shortage in a period of relatively low overall shortage. It may well be that the increase in demand from 1986 to the present represents a period of adjustment following considerable and far-reaching changes in the hospital sector since the introduction of prospective payment, as suggested by Aiken (1988).

As noted in Section I, this examination of hospital shortage factors based on the AHA data on non-federal short-term general hospitals cannot by definition account for the larger factors governing nurse supply and demand within the health care sector. Nor can it address larger labor market issues affecting nurse supply and demand on a national basis. Among these are the competition for job market entrants of nursing with historically comparable professions in terms of training, social standing, and financial reward, or of the more recent career opportunities in computing or the large range of social services outside the nursing sector. Inferences for the currently perceived shortages should be made cautiously, therefore; these data should not be used as a basis for predicting the likely responses of hospitals to future changes in market conditions or health policies. Economic and policy predictions will require a model of the demand for and supply of RNs, perhaps including effects of changes in non-nursing labor markets on nursing supply. In addition, the shortcomings of current nursing shortage measures must be addressed and data must be collected consistently over time.

There is ample indication within the data used in this report that finer and more focused measures might yield more concrete and specific answers. Such measures range from the importance of relative versus absolute financial rewards, job status and satisfaction, to life-time career opportunities, relief from shift constraints, and such fringe benefits as day care opportunities for nurses with children. Another focus of potential interest is the importance of relative distributions of supply and demand within the registered nurse staff, both within and across hospitals. Is the higher shortage perceived by apparently well-staffed hospitals, many of them with teaching affiliations and similar structural characteristics of high-intensity patient care, due to a shortage of intensive care or medical/surgical nurses that is not clearly articulated by current measures of nurse staffing?

These questions require careful attention in terms of precise and sensitive measures. In turn, these might yield more persuasive answers than are currently available to a puzzled research and policy community trying to reconcile an apparently large supply of registered nurses with clear signals of shortage reported by the country's hospitals.

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APPENDIX

LIST OF TABLES

TABLE A1: A comparison of hospitals responding to the 1987 Hospital Nursing Personnel Survey (HNPS) with all short-term general non-Federal hospitals in the United States.

TABLE A2: Cross-sectional, bivariate relationships between RN vacancies as a fraction of all budgeted RN positions and selected hospital characteristics for years 1982 and 1984.

TABLE A3: Cross-sectional, bivariate relationships between shortage as measured by RNs per 100 patient days and selected hospital characteristics for the years 1982, 1984, and 1986.

TABLE A4: Selected characteristics for 1986 of non-Federal, short-term general hospitals reporting mild or severe nursing shortage in the 1987 Hospital Nursing Personnel Survey.

TABLE A5: Cross-sectional, bivariate relationships between the reporting of a shortage on the 1987 HNPS and selected hospital characteristics in the years 1982, 1984, and 1986.

TABLE A6: Cross-sectional, bivariate relationships between RN vacancies as a fraction of all RN positions and subsequent changes in selected hospital characteristics; vacancies in 1982 and 1984 are related to changes in 1982-84 and 1984-86, respectively.

TABLE A7: Cross-sectional, bivariate relationships between shortage as measured by RNs per 100 patient days and subsequent changes in selected hospital characteristics; vacancies in 1982 and 1984 are related to changes in 1982-84 and 1984-86, respectively.

TABLE A8: Relationships between shortage reported on 1987 HNPS and changes in selected hospital characteristics for 1982-84 and 1984-86.

Note: Throughout these analyses, significance levels are indicated as follows:

** indicates P<.01,
* indicates P<.05, and
? indicates P<.1 (for HCUP variables only).

The number of observations used to calculate means varies greatly--based upon the availability of data. The following table provides basic guidance about the average number of observations in a shortage "group" (e.g., low or high) for particular combinations of years, shortage measures, and data sources. Total numbers of observations available for this analysis were roughly three times the counts given below for RNs per 100 patient days and for AHA vacancy rates; they were roughly twice the counts given for shortage based on the 1987 HNPS.

	AHA Variables			HCUP Variables		
Shortage measure	1982	1984	1986	1982	1984	1986
RNs per 100 patient days	1,380	1,300	1,320	120	70	139
AHA vacancy rates	860	730	n.a.	90	65	n.a.
Self-report of shortage (1987 HNPS)	275	275	275	27	29	25

TABLE A1: A comparison of hospitals responding to the 1987 Hospital Nursing Personnel Survey (HNPS) with all short-term general non-Federal hospitals in the United States.

Hospital characteristics	HNPS		Universe
Number of hospitals	651		5,543
Average Number of beds	194.8	**	170.6
Percent distributed by ownership/control[a]			
Private, not-for-profit	65.7		57.6
Public	24.3		27.4
Proprietary	10.0		14.9
U.S. Census region, percent			
Northeast	16.7		14.2
North Central	29.2		29.3
South	35.5		37.8
West	18.6		18.7
Hospitals located in an MSA, percent	52.8		52.0
Hospital teaching status, percent			
Medical school affiliation	18.0	**	14.5
COTH	8.14	**	6.13
Professional nursing school	5.07	**	4.28
RN vacancy rate, 1984	3.19		3.14
FTE RNs per			
100 admissions	2.08	**	2.02
1000 inpatient days	3.56		3.55
1000 adjusted patient days[b]	2.14		2.17
FTE nursing staff (RN, LPNs, and ancillaries) per			
100 admissions	3.46		3.44
1,000 inpatient days	5.95	**	6.11
Nursing personnel costs as percent of total costs, 1984	17.2		17.1
Total nursing payroll per FTE nurse, 1984	$21,700	**	$21,200
Casemix indicators			
Average length of stay, short-term admissions, days	6.18	**	5.95
Live births per 100 short-term admissions	9.34		9.51
Inpatient surgeries per short-term admissions	32.9	**	31.6
ICU days as percent of total inpatient days	6.09	*	5.92
Medicare days as percent of total inpatient days	44.1		44.0

* P<.05; ** P<.01.

[a] The distributions are significantly different (P<.01).

TABLE A1 (continued)

[b] Using AHA approach for outpatient visits. It also assumes that special care patients are assumed to need four times as much nursing as other patients.

Source: Computations provided by the Hospital Studies Program (HSP), National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on data provided by the American Hospital Association.

TABLE A2: Cross-sectional, bivariate relationships between RN vacancies as a fraction of all budgeted RN positions and selected hospital characteristics for years 1982 and 1984.

	1982			1984		
Hospital characteristics	Low		High	Low		High
Percent distribution by bedsize						
< 100 beds	22.6	**	29.5	29.6	**	18.7
100-249 beds	38.0		38.9	39.6	**	31.0
250-499 beds	30.0	**	23.5	23.3	**	39.2
500+ beds	9.4		8.1	7.5	*	11.2
Percent distribution by ownership						
Public	11.6	**	37.6	15.9	**	27.8
Private, not-for-profit	77.8	**	54.9	67.0		67.3
Private, investor-owned	10.6	*	7.5	17.0	**	4.9
Percent distribution by region						
Northeast	21.9	**	16.5	17.8	*	22.9
North Central	30.2	**	24.1	29.7	**	23.2
South	27.0	**	47.8	31.7	**	38.7
West	21.0	**	11.5	20.7	**	15.1
FTE RNs per 100 short-term beds	71.8	**	54.2	70.0		69.0
Salary expense per FTE RN and LPN	$18,249		$17,829	$21,952		$21,971
Nursing salaries as percent of						
Total hospital expenses	17.3	**	16.6	17.2	*	16.8
All salaries	35.9	**	34.5	37.1	**	34.7
Percent due to Medicare						
Revenues[a]	37.2		38.0	38.7		40.4
Inpatient days	44.1		43.4	45.7	**	43.7
Admissions	32.7		33.1	35.2	**	33.6
Percent with						
Urban location	69.5	**	55.9	68.8	*	73.0
Medical school affiliation	19.6		19.3	16.9	**	31.7
Member, COTH	7.8		8.8	7.1	**	16.1
Nursing school	8.6		6.8	6.1	**	11.2
Tie to multihospital system	35.3		31.7	43.9	**	35.9
Formal HMO relationship	26.2	**	19.2	33.5		35.6
Formal PPO relationship		n.a.		24.3		22.7
Separate long-term care unit	8.6	*	11.6	8.9		10.1
Aggregate utilization data						
Average length of stay	7.92		8.03	6.84		7.35
Occupancy rate	74.1	**	71.0	64.9	**	68.8
Discharges per bed	38.5	**	36.2	36.8		36.5
Total Outpatient visits per admission	6.76		6.67	5.82	**	6.57
All-payer LOS-weighted casemix index[a]	6.68	?	6.50	7.00		7.02
Casemix-adjusted average LOS[a]	6.76		7.00	5.81	**	6.23

TABLE A2 (continued)

Hospital characteristics	1982 Low		1982 High	1984 Low		1984 High
Cost per adjusted admission	$2,184	**	$1,994	$2,596		$2,644
Operating surplus as percent of expenses[a]	4.19		3.69	5.79		4.48
Ratios with FTE RNs in denominator						
FTE LPNs and LVNs	.411	**	.701	.379	**	.444
Contract RNs	.009	**	.026	.004	*	.009
Part-time RNs	.443	**	.396	.448		.433
Alternative nursing shortage measures						
FTE RNs per 100 inpatient days	.269	**	.213	.303	**	.276
Vacancy rate for RNs	.028	**	.149	.024	**	.107
Percent reporting shortage in 1987	76.2		79.2	72.9	**	88.9

[a] Available only for hospitals in the HCUP-2 sample.

* P<.05; ** P<.01. 7 = P<.10, for variables only available in the HCUP-2 sample.

n.a. = not available.

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 860 observations in 1982 and 1,300 observations in 1984. Means limited to HCUP-2 hospitals are computed from an average of roughly 90 hospitals in each shortage group for 1982 and 65 hospitals for 1984. Total observations available for this analysis were roughly three times these annual counts.

Source: Computations provided by the Hospital Studies Program (HSP), National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A3: Cross-sectional, bivariate relationships between shortage as measured by RNs per 100 patient days and selected hospital characteristics for the years 1982, 1984, and 1986.

	1982		1984		1986	
Hospital characteristics	Low	High	Low	High	Low	High
Percent distribution by bedsize						
< 100 beds	28.1 **	55.0	33.2 **	49.8	37.7 **	44.8
100-249 beds	33.5	32.2	32.4	33.9	34.0	33.3
250-499 beds	27.6 **	10.9	25.1 **	13.2	22.2 **	17.8
500+ beds	10.8 **	2.1	9.3 **	3.3	6.1 *	4.3
Percent distribution by ownership						
Public	19.3 **	41.8	21.8 **	36.4	21.6 **	32.4
Private, not-for-profit	72.9 **	46.4	69.9 **	51.5	68.7 **	55.8
Private, investor-owned	7.8 **	11.8	8.3 **	12.1	9.8	11.9
Percent distribution by region						
Northeast	22.3 **	6.2	16.8 **	10.0	13.9	15.0
North Central	25.7 *	29.7	30.9	29.5	35.2 **	25.5
South	17.3 **	60.3	15.9 **	57.2	18.8 **	55.0
West	34.7 **	3.8	36.4 **	3.3	32.1 **	4.5
FTE RNs per 100 short-term beds	83.9 **	33.2	83.3 **	38.1	89.1 **	45.6
Salary expense per FTE RN and LPN	$17,941	$17,656	$21,403	$20,953	n.a.	
Nursing salaries as a percent of						
Total expenses	17.6 **	16.6	17.4 **	16.9	n.a.	
All salaries	36.2 **	35.0	36.7 *	36.1	n.a.	
Percent due to Medicare						
Revenues[a]	36.6 **	42.3	36.4 **	41.7	39.8 **	42.8
Inpatient days	41.7 **	47.5	42.1 **	47.2	42.2 **	45.6
Admissions	31.6 **	37.2	34.3 **	39.2	34.9 **	39.0
Percent with						
Urban location	69.0 **	31.8	67.1 **	35.8	62.3 **	42.6
Medical school affiliation	26.0 **	4.6	24.1 **	7.8	20.3 **	11.0
Member, COTH	12.3 **	1.0	12.8 **	1.5	11.2 **	3.2
Nursing school	8.7 **	3.0	7.5 **	3.5	5.9	4.7
Tie to multihospital system	32.9	29.9	37.1	35.0	34.6	32.5
Formal HMO relationship	30.6 **	7.1	41.3 **	13.7	57.4 **	33.9
Formal PPO relationship	n.a.		28.6 **	8.3	49.3 **	32.4
Separate long-term care unit	13.3	14.4	14.9	13.2	16.9	16.1

TABLE A3 .(continued)

Hospital characteristics	1982 Low	1982 High	1984 Low	1984 High	1986 Low	1986 High
Aggregate utilization						
Average length of stay	8.41	8.04	8.13 *	7.59	8.18	8.28
Occupancy rate	71.5 **	66.8	63.1 **	61.4	56.2 *	57.7
Discharges per bed	37.4 **	34.8	35.1 **	33.8	32.9 **	30.8
Total outpatient visits per admission	8.07 **	5.03	6.99 **	4.60	8.48 **	6.35
All-payer LOS-weighted casemix index[a]	6.67	6.54	6.72	6.77	7.28	7.12
Casemix-adjusted average LOS[a]	6.45	6.42	4.75 **	5.52	4.82 **	5.24
Cost per adjusted admission	$2,378 **	$1,575	$2,844 **	$1,934	$3,132 **	$2,413
Operating surplus as percent of expenses[a]	3.54	4.02	5.18	5.17	4.20	4.21
Ratios with FTE RNs in denominator						
FTE LPNs and LVNs	.299 **	.981	.251 **	.810	.221 **	.681
Contract RNs	.011	.012	.004 *	.009	n.a.	
Part-time RNs	.502 **	.380	.520 **	.381	.498 **	.363
Alternative shortage measures						
FTE RNs per 100 inpatient days	.341 **	.140	.388 **	.175	.480 **	.226
Vacancy rate for RNs	.039 **	.060	.033	.031	n.a.	
Percent reporting shortage (1987)	77.6	74.3	77.0	75.9	72.6	76.6

[a] Available only for hospitals in the HCUP-2 sample.

* P<.05; ** P<.01.

n.a. = not available.

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 1,380 observations in 1982, 1,300 in 1984, and 1,320 in 1986. Means limited to HCUP-2 hospitals are computed from an average of roughly 120 in each shortage group for 1982, 70 for 1984, and 139 for 1986. Total observations available for this analysis were roughly three times these annual counts.

Source: Computations provided by the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, DDHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A4: Selected characteristics for 1986 of non-Federal, short-term general hospitals reporting mild or severe nursing shortage in the 1987 Hospital Nursing Personnel Survey.

1986 Hospital characteristics	1987 Shortage reported: Mild		Severe
Percent distribution by bedsize			
< 100 beds	47.0	**	28.0
100-249 beds	32.2		33.2
250-499 beds	18.2	**	28.0
500+ beds	2.5	**	10.9
Percent distribution by ownership			
Public	27.1	*	18.4
Private, not-for-profit	65.3		73.4
Private, investor-owned	7.6		8.2
Percent distribution by region			
Northeast	12.3	**	24.3
North Central	32.6		25.3
South	36.0		33.9
West	19.1		16.4
Percent with			
Urban location	46.2	**	63.8
Medical school affiliation	13.1	**	25.3
Member, COTH	4.7	**	11.8
Nursing school	4.2		6.9

* P<.05; ** P<.01.

The means in this table are based on approximately 275 observations. There was a total of roughly 550 observations available for this analysis.

Source: Computations provided by the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A5: Cross-sectional, bivariate relationships between the reporting of a shortage on the 1987 HNPS and selected hospital characteristics in the years 1982, 1984, and 1986.

	1982		1984		1986	
	1987 shortage report					
Hospital characteristics	Mild	Severe	Mild	Severe	Mild	Severe
FTE RNs per 100 short-term beds	571 *	62.6	59.1 **	66.1	66.6 **	73.3
Salary expense per FTE RN and LPN	$17,344	$18,336	$22,062	$22,237	n.a.	
Nursing salaries as a percent of						
Total expenses	17.3	16.8	17.3	17.2	n.a.	
All salaries	35.9 *	34.3	36.6	35.8	n.a.	
Percent due to Medicare						
Revenues[a]	36.3	39.2	38.1	40.2	39.2	39.8
Inpatient days	45.1	43.2	45.7	44.8	44.3	44.4
Admissions	34.8 *	33.0	37.2 *	35.3	37.1 *	35.5
Percent with						
Tie to multihospital system	30.9	34.2	33.1	37.8	28.1 *	40.2
Formal HMO relationship	16.2	22.0	20.8 *	30.3	39.7 *	51.7
Formal PPO relationship	n.a.		12.2	17.2	37.3	39.7
Separate long-term care unit	14.0	17.1	13.1	16.8	17.8	20.4
Aggregate utilization						
Average length of stay	8.11	8.14	7.68	7.79	7.79	7.72
Occupancy Rate	69.6 **	73.2	63.0 **	67.4	57.0 **	61.8
Discharges per bed	36.5	36.0	35.7	35.3	32.6	33.2
Total outpatient visits per admission	6.65	7.62	6.05	6.84	7.82	8.15
All-payer LOS-weighted casemix index[a]	6.55	6.58	6.74	6.84	7.11	7.17
Casemix-adjusted Average LOS[a]	6.53	7.07	5.44	5.77	5.18	5.24
Cost per adjusted admission	$1,876 **	$2,159	$2,245 **	$2,598	$2,670 **	$3,025
Operating Surplus as percent of expenses[a]	3.98	1.83	5.78	6.46	4.91	4.53
Ratios with FTE RNs in denominator						
FTE LPNs and LVNs	.612	.560	.473	.446	.428 *	.358
Contract RNs	.014	.011	.005	.005	n.a.	
Part-time RNs	.459	.415	.438	.419	.414	.406
Alternative shortage measures						
Vacancy rate for RNs	.052 *	.072	.034	.047	n.a.	
Percent reporting shortage (1987)	.483 **1.000		.483 **1.000		.483 **1.000	

[a] This variable is only available for hospitals in the HCUP-2 sample.

TABLE A5 (continued)

* P<.05; ** P<.01. ? P<.10 is used for variables only available in the HCUP-2 sample.

n.a. = not available

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 275 observations in 1982, 1984, and 1986. Means limited to HCUP-2 hospitals are computed from an average of roughly 27 hospitals in each shortage group for 1982, 29 for 1984, and 25 for 1986. Total numbers of observations available for this analysis were roughly twice these annual counts.

Source: Computations provided by the Hospital Studies Program (HSP), National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A6: Cross-sectional, bivariate relationships between RN vacancies as a fraction of all RN positions and subsequent changes in selected hospital characteristics; vacancies in 1982 and 1984 are related to changes in 1982-84 and 1984-86, respectively.

	1982-84 changes		1984-86 changes	
Hospital characteristics	Low	High	Low	High
Number of beds				
Total institution	-0.7	-1.9	-7.7 **	-14.2
Hospital portion	-0.7	-1.9	-9.2 **	-14.6
FTE RNs per 100 short-term beds	0.6 **	6.2	6.0 *	7.9
Salary expense per FTE RNs and LPNs	$3,622 *	$3,022	n.a.	
Nursing salaries as percent of				
Total expenses	-0.2 **	0.4	n.a.	
All salaries	0.4 *	1.3	n.a.	
Percent due to Medicare				
Revenues[a]	1.9	1.8	0.5	0.7
Inpatient days	1.2	0.9	-0.5 *	0.5
Admissions	2.2	2.2	0.2	0.6
Percent with				
Tie to multihospital system	4.2	3.6	-1.4	-1.4
Formal HMO relationship	12.8 **	5.7	21.3	22.1
Formal PPO relationship	n.a.		24.6	26.9
Separate long-term care unit	1.2 *	-0.3	4.0	2.7
Aggregate utilization data				
Average length of stay	-0.94	-0.48	-0.08	-0.19
Occupancy rate	-7.1 *	-6.2	-6.3 **	-5.0
Discharges per bed	-1.56	-1.06	-2.5 **	-1.4
Total Outpatient visits per admission	-0.76	-0.88	1.56 *	1.13
All-payer LOS-weighted casemix index[a]	0.35	0.29	0.41	0.36
Casemix-adjusted average LOS[a]	-0.97	-1.15	-0.36	-0.39
Cost per adjusted admission	$433	$408	$412	$457
Operating surplus as percent of expenses[a]	2.4	1.0	-0.1	0.4
Ratios with FTE RNs in denominator				
FTE LPNs and LVNs	-.064 **	-.156	-.071 *	-.092
Contract RNs	-.006 **	-.019	n.a.	
Part-time RNs	.001 **	-.023	-.006	-.024
Changes in alternative nursing shortage measures				
FTE RNs per 100 inpatient days	.033	.049	.069	.062
Vacancy rate for RNs	.003 **	-.098	n.a.	

TABLE A6 (continued)

This variable is only available for hospitals in the HCUP-2 sample.

* P<.05; ** P<.01. ? = P<.10 is used for variables only available in the HCUP-2 sample.

n.a. = not available

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 860 observations for 1982-84 and 730 for 1984-86. Means limited to HCUP-2 hospitals are computed from an average of roughly 100 hospitals in each shortage group for 1982-84 and 85 hospitals for 1984-86. Total observations available for this analysis were roughly three times these annual counts.

Source: Computations provided by the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A7: Cross-sectional, bivariate relationships between shortage as measured by RNs per 100 patient days and subsequent changes in selected hospital characteristics; vacancies in 1982 and 1984 are related to changes in 1982-84 and 1984-86, respectively.

	1982-84 changes			1984-86 changes		
Hospital characteristics	Low		High	Low		High
Number of beds						
Total institution	-0.1		-1.5	-9.2		-7.3
Hospital portion	0.1		1.6	-9.6		-8.2
FTE RNs per 100 short-term beds	-1.8	**	6.1	4.4	**	7.4
Salary expense per FTE RNs and LPNs	$4,428	**	$2,297	n.a.		
Nursing salaries as percent of						
Total expense	-0.2	**	0.3	n.a.		
All salaries	0.4	*	1.1	n.a.		
Percent due to Medicare						
Revenues[a]	2.4	7	0.5	0.6		0.2
Inpatient days	1.2	**	-0.6	-0.7		-1.1
Admissions	2.6		2.2	.01		0.1
Percent with						
Tie to multihospital system	2.8		4.1	-1.1		-3.5
Formal HMO relationship	10.5	**	3.0	19.2		16.6
Formal PPO relationship		n.a.		24.0		24.9
Separate long-term care unit	0.1		0.1	2.4		3.5
Aggregate utilization data						
Average length of stay	-0.51		-0.44	0.36		0.36
Occupancy rate	-5.6	**	-8.0	-3.6	**	-8.1
Discharges per bed	-1.1	**	-2.1	-1.4	**	-3.8
Total Outpatient visit per admission	-1.08	**	-0.48	1.65		1.74
All-payer LOS-weighted casemix index[a]	0.35		0.33	0.36		0.30
Casemix-adjusted average LOS[a]	-1.05		-0.89	-0.40		-0.41
Cost per adjusted admission	$456	*	$325	$449	*	$401
Operation surplus as percent of expenses[a]	1.4		0.9	-0.2		1.0
Ratios with FTE RNs in denominator						
FTE LPNs and LVNs	-.034	**	-.206	-.035	**	-.155
Contract RNs	-.007		-.006	n.a.		
Part-time RNs	.017	**	-.031	-.025		-.035
Changes in alternative nursing shortage measures						
FTE RNs per 100 inpatient days	.020	**	.055	.056	**	.080
Vacancy rate for RNs	-.004	**	-.034	n.a.		

a This variable is only available for hospitals in the HCUP-2 sample.

* P<.05; ** P<.01. 7 = P<.10 is used for variables only available in the HCUP-2 sample.

TABLE A7 (continued)

n.a. = not available

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 1,380 observations for 1982-84, and 1,300 in 1984-86. Means limited to HCUP-2 hospitals are computed from an average of roughly 140 hospitals in each shortage group for 1982-84, and 142 hospitals for 1984-86. Total observations available for this analysis were roughly three times these annual counts.

Source: Computations provided by the Hospital Studies Program (HSP), National Center for Health Services Research and Health Care Technology Assessment, DDHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

TABLE A8: Relationships between shortage reported on 1987 HNPS and changes in selected hospital characteristics for 1982-84 and 1984-86.

Hospital characteristics	1982-84 changes		1984-86 changes	
	Mild	Severe	Mild	Severe
Number of beds				
Total institution	-2.5	-1.3	-6.6	-10.0
Hospital portion	-2.5	-0.8	-7.8	-11.3
FTE RNs per 100 short-term beds	2.0	3.5	7.4	7.2
Salary expense per FTE RNs and LPNs	$4,720	$3,933	n.a.	
Nursing salaries as percent of				
Total expenses	-0.0	0.4	n.a.	
All salaries	0.6	1.6	n.a.	
Percent due to Medicare				
Revenues[a]	1.6	1.0	1.1	0.0
Inpatient days	0.7	1.6	-1.4	-0.5
Admissions	2.4	2.4	-0.1	0.2
Percent with				
Tie to multihospital system	2.1	3.8	-4.8	1.4
Formal HMO relationship	4.7	8.2	18.3	20.3
Formal PPO relationship	n.a.		25.6	23.5
Separate long-term care unit	-0.8	-0.3	4.7	3.6
Aggregate utilization data				
Average length of stay	-0.43	-0.35	0.12	-0.07
Occupancy rate	-6.6	-5.8	-5.9	-5.6
Discharges per bed	-0.8	-0.7	-3.1 *	-2.1
Total Outpatient visits per admission	-0.60	-0.79	1.77	1.31
All-payer LOS-weighted casemix index[a]	0.26	0.27	0.34	0.27
Casemix-adjusted average LOS[a]	-1.05	-1.29	-0.29	-0.58
Cost per adjusted admission	$369	$438	$426	$586
Operation surplus as percent of expenses[a]	2.0	4.5	-0.8	-1.8
Ratios with FTE RNs in denominator				
FTE LPNs and LVNs	-.139	-.113	-.045 **	-.091
Contract RNs	-.009	-.006	n.a.	
Part-time RNs	-.022	.004	-.024	-.014
Alternative nursing shortage measures				
FTE RNs per 100 inpatient days	.038	.040	.077	.065
Vacancy rate for RNs	-.018	-.018	n.a.	

[a] This variable is only available for hospitals in the HCUP-2 sample.

P<.05, ** P<.01. 7 = P<1.0 is used for variables only available in the HCUP-2 sample.

TABLE A8 (continued)

n.a. = not available

The number of observations used to calculate means varies greatly because of differences in the availability of data. Most of the means in this table are based on approximately 550 observations 275 in each shortage group. Means limited to HCUP-2 hospitals are computed from an average of roughly 27 hospitals in each shortage group and 54 observations overall.

Source: Computations provided by the Hospital Studies Program, National Center for Health Services Research and Health Care Technology Assessment, DHHS, based on casemix data collected as part of the Hospital Cost and Utilization Project and other data furnished by the American Hospital Association.

*U.S. Government Printing Office: 1989-241-274/00019